

# 2016 and 2019 Flagstaff Community Greenhouse Gas Emissions Report

## Executive Summary

The Flagstaff community contributes to climate change by releasing greenhouse gas (GHG) emissions - carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxides (N<sub>2</sub>O), and others - that trap heat inside the atmosphere. Climate change occurs when the concentration of greenhouse gasses inside the atmosphere increases.

Reducing our contribution to climate change means reducing our greenhouse gas emissions, which starts with knowing where we are now. GHG emissions reporting helps us measure the impact of the Flagstaff community's activities so that we can:

- Understand the scale of our GHG emissions and what activities cause them,
- Identify what types of actions the City and community can take to reduce Flagstaff's GHG emissions, and
- Track our future progress as we work to implement the Flagstaff Climate Action and Adaptation Plan (CAAP).

This report presents the GHG inventory of 2019 and places the CAAP emission reduction goals into context. The inventory results show that most of Flagstaff's GHG emissions continue to come from driving cars and powering buildings, and finds that our community emissions have been increasing over time along the expected business as usual scenario.

## 2019 Emissions

### Greenhouse Gas Emissions, by Sector

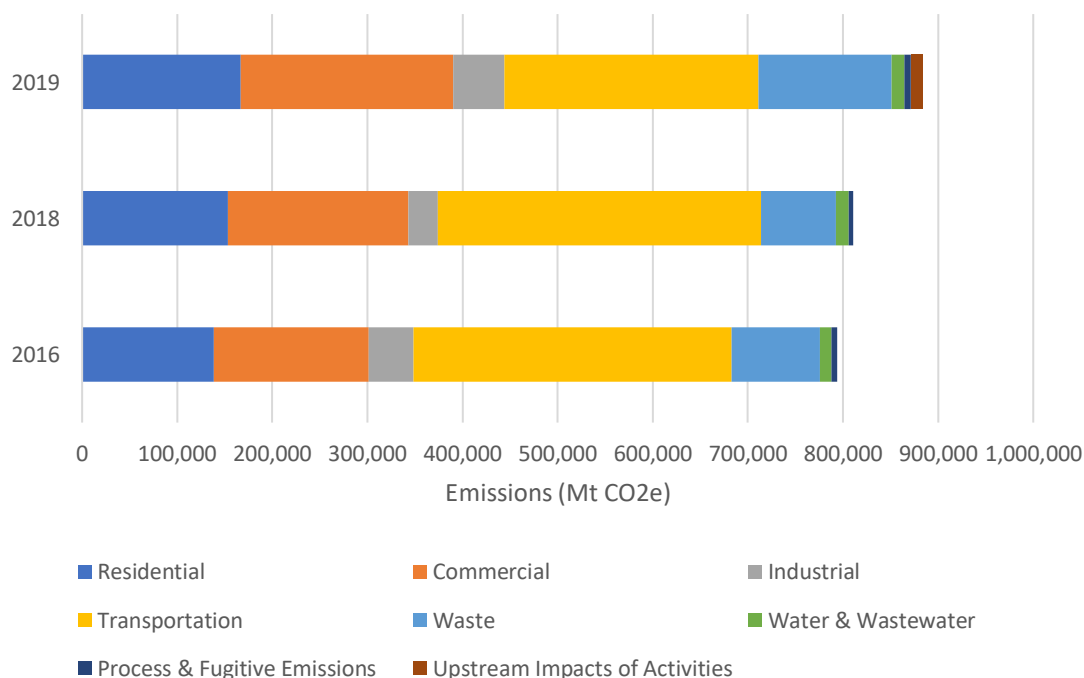


Figure 1

In 2016, the City of Flagstaff's total community emissions were 794,135 metric ton carbon dioxide equivalent (Mt CO<sub>2</sub>e), as illustrated in Figure 1 and Table 1.<sup>1</sup> In 2019, our community emissions increased approximately 11% compared to 2016.

**Table 1.** Sector emissions for 2016 and 2019 in Mt CO<sub>2</sub>e.

	2016	2019	Change
City Population	71,455	75,038	5%
City GDP	\$7,016M	\$7,718M	10%
Residential Energy Emissions	138,472	167,009	21%
Commercial Energy Emissions	163,107	222,819	37%
Industrial Energy Emissions	46,617	54,021	16%
Transportation Emissions	334,858	267,452	-20%
Waste Emissions	92,648	139,956	51%
Water & Wastewater Emissions	11,954	13,393	12%
Process & Fugitive Emissions	6,479	6,542	1%
Upstream Impacts of Activities	Not accounted	12,269	
<b>Total</b>	<b>794,135</b>	<b>883,461</b>	<b>11%</b>

The 11% increase in emissions from 2016 to 2019 should be considered with the following factors in mind:

- The population in Flagstaff increased by 5% over the same period.
- In 2019 the treatment of daily vehicle miles traveled (VMT) was updated, resulting in a net reduction in transportation emissions.
- The protocol for the waste sector was updated from an in-jurisdiction protocol to a methane-commitment protocol. While this change increases the annual emissions accounted in this sector, it also creates a reporting framework that increases the emissions reduction impact potential for successful waste diversion efforts. The pivot to utilizing this method will be reviewed in future inventory years.
- In 2019, contractual natural gas was accounted for the first time. Since a sector breakdown for this contractual natural gas could not be provided at this time, for accounting purposes it was split 50:50 between the commercial and industrial sectors. Thus, both sectors saw an increase in emissions. If a more targeted sector accounting can be provided in future years, this approach will be updated.
- In 2019, upstream impacts of activities (mainly losses from power transmission and distribution) were incorporated for the first time, increasing overall emissions.

<sup>1</sup> Metric ton carbon dioxide equivalent (Mt CO<sub>2</sub>e) serves as a standard unit for greenhouse gases, indicating the impact of different greenhouse gases in terms of the amount of CO<sub>2</sub> that would create the same amount of global warming. For example, methane has 28 times the impact of carbon dioxide in the atmosphere, so 1 metric ton of methane would equal 28 Mt CO<sub>2</sub>e.

## Emissions by Sector

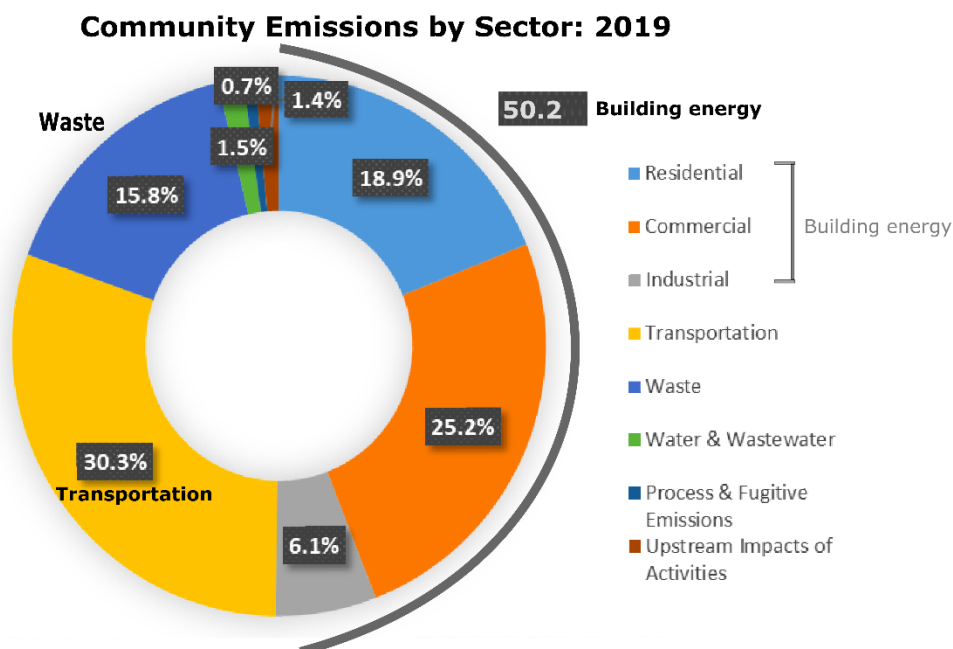
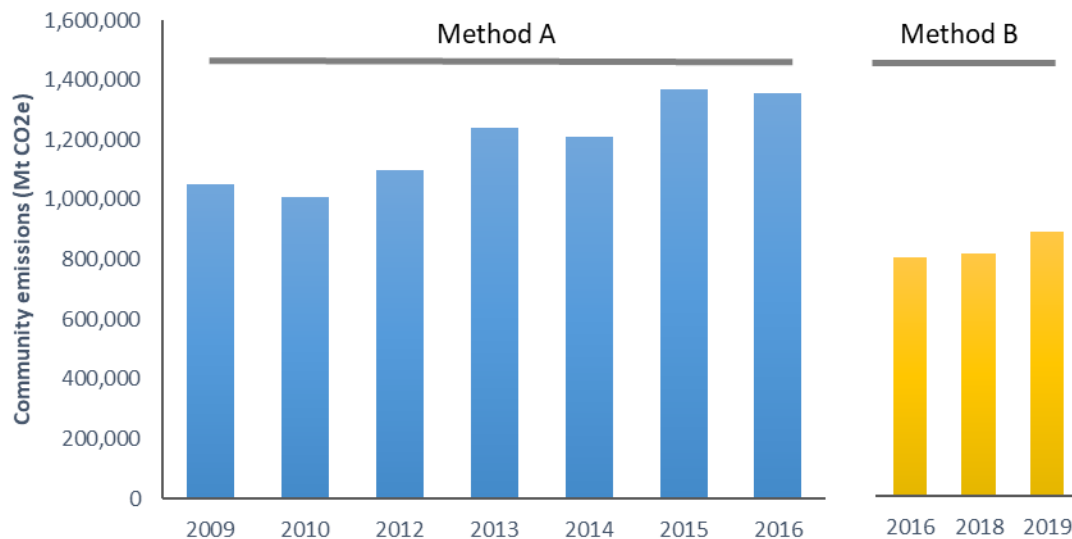
**Figure 2**

Figure 2 illustrates that 80.5% of Flagstaff's community emissions come from just two sectors:

- **Building Energy** (50.2%), which represents emissions coming from the use of electricity and natural gas, in our homes, commercial and industrial buildings. Most of those building energy emissions are split between commercial and residential buildings.
- **Transportation** (30.3%), which is from the fuels we use to get around town.

While smaller relative to other sectors, the emissions from solid waste (15.8%), water and wastewater treatment (1.5%), upstream impacts of activities (1.4%), and process and fugitive emissions (0.7%) are all important to measure and manage in order to achieve our emissions reduction goals.

## Flagstaff's Emissions over Time



**Figure 3.** Total annual community emissions for years 2009-2016 using method A (in blue), and for years 2016-2019, using method B (in yellow).

The City of Flagstaff has been tracking community greenhouse gas emissions since 2006. Since then, the way we track emissions has evolved. While the City has tracked similar sectors of emissions over time, the methodologies used to track these emissions has changed significantly. Though global and national greenhouse gas emissions have been measured for decades, the first Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) was only launched in 2014. The establishment of this global standard for community level greenhouse gas inventories created a reliable methodology that now helps Flagstaff compare its emissions to other communities. Prior to 2016, the City tracked emissions using the draft International Local Government Greenhouse Gas Emissions Analysis Protocol (IEAP), referred to as Method A in this report. From 2009 to 2016, the general trend observed was of steadily increasing community emissions (see Figure 3).

As part of the development of Flagstaff's Climate Action and Adaptation Plan, the City began using the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. For the 2016 inventory, the City transitioned from Method A to the U.S.-specific counterpart to the GPC framework, the U.S. Community Protocol, referred to as Method B in this report. Method B was used for the 2016, 2018 and 2019 GHG inventories. The baseline emissions for our community in the Climate Action and Adaptation Plan, as well as the associated emissions reduction goals, are entirely based on the 2016 inventory that was completed using the standardized U.S. GPC method – method B. To compare the two methods, the City of Flagstaff performed two community level greenhouse gas inventories in 2016 - one using method A and one using method B. This comparison illustrated that:

- Method A had likely been overestimating our total community emissions.
- In particular, Method A had a less sophisticated protocol for calculating vehicle emissions within a community. While the reported values for the total community emissions in Flagstaff before 2016 are likely to be over-calculated compared to the new standardized protocol, the observed trend of steadily increasing community emissions between 2009 and 2016 would remain regardless of the method used.

Due to the significant differences in techniques between method A and method B, it is difficult to compare community emissions across all inventory years. However, community emissions increased over time using both inventory methods - between 2009 and 2016, as well as between 2016 and 2019. This trend of increasing emissions is mirrored in communities across the US.

## Emissions and CAAP goals

The Flagstaff Climate Action and Adaptation Plan (CAAP) established a goal to reduce Flagstaff community emissions by 80% by 2050, based on a baseline measurement of emissions in 2016. This aggressive target is in line with the Paris Climate Agreement targets, and is often referred to as our 80 by 50 goal, or just '80x50.' The target is broadly accepted by peer cities and states across the US, although it falls short of the scientific understanding of what reductions are necessary to avoid catastrophic climate change.<sup>2</sup>

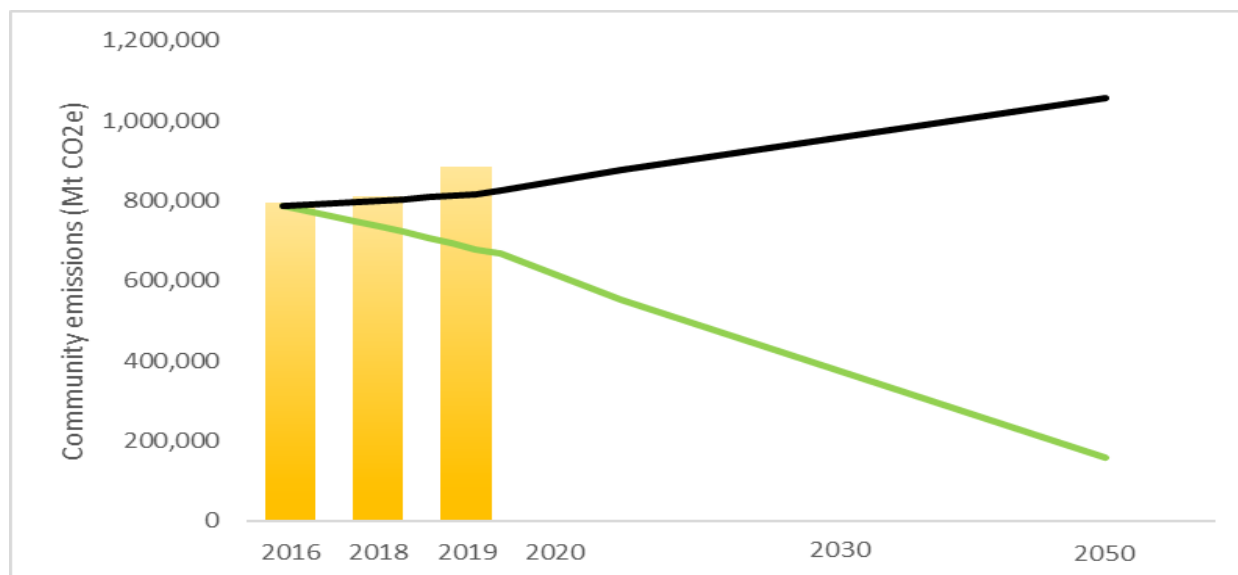
One way to compare our goals to where we are today is by using a "wedge" diagram (Figure 4). The wedge uses the total community emissions from 2016 as the starting point and models two possible future outcomes:

- A business as usual (BAU) scenario where no action is taken to reduce community emissions. In the BAU scenario, emissions steadily rise in conjunction with projected community and economic growth. This would mean a projected 34% increase in Flagstaff-caused emissions by 2050 (Table 2).
- An emissions reduction scenario where Flagstaff takes aggressive climate action and reduces emissions by 80% from the 2016 baseline by 2050.

The 'wedge' is the difference between the two scenarios, and represents the emissions reductions needed to meet our goals. Our emissions in 2019 exceed the business as usual scenario. As the City of Flagstaff continues to conduct annual greenhouse gas inventories, we will plot the outcomes of these inventories onto the wedge diagram. This will help us track our progress towards our emissions reduction goals.

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<sup>2</sup> The CAAP was developed to comply with the science-based targets of the Paris Climate Agreement, designed to keep global warming to 2° Celsius. In October 2018, the Intergovernmental Panel on Climate Change released the Special Report on Global Warming of 1.5° C, on the significant benefits of limiting warming to 1.5° C. While the CAAP had been developed when this report was released, it noted the Flagstaff community would need to discuss the findings of the report and consider setting more aggressive goals. See the report at <https://www.ipcc.ch/sr15/>.



**Figure 4.** Wedge diagram showing the business as usual future projection (black line), the future with reductions in emissions (green line), and the emission inventory results for 2016, 2018, and 2019 (yellow bars).

**Table 2.** Future emission scenarios and the CAAP goals as per the 2016 baseline. Emissions are in Mt CO<sub>2</sub>e.

Performance Indicator	2016 Emissions Baseline	2019 Emissions	2025 Target	2030 Target	2050 Target
			15% reduction	30% reduction	80% reduction
Community emissions	787,315 <sup>3</sup>	883,461	669,218	551,121	157,463

### How will we get there?

Achieving an 80% reduction by 2050 will require significant change from everyone in the Flagstaff community. Examples of changes identified by the CAAP include:

- Reducing or diverting 80% of landfill waste
- Reducing personal vehicle use by 20%
- Switching 60% of on road vehicles to zero emissions
- Acquiring at least 60% of electricity from renewable sources
- Reducing building energy use by at least 80%

<sup>3</sup> At the time the CAAP was published, the 2016 community greenhouse gas emissions were calculated to be 787,315 Mt CO<sub>2</sub>e. While subsequent calculations revised 2016 emissions to 794,135 Mt CO<sub>2</sub>e as referenced in this report, for the time being the City will continue to utilize the emissions calculated in 2016 as the baseline for the CAAP for its CAAP targets.

The strategies in the CAAP will lead to a reduction in community emissions by 60%, as seen in Figure 5. New strategies and actions will need to be added to the CAAP over time to achieve the final 20% reduction from the baseline.

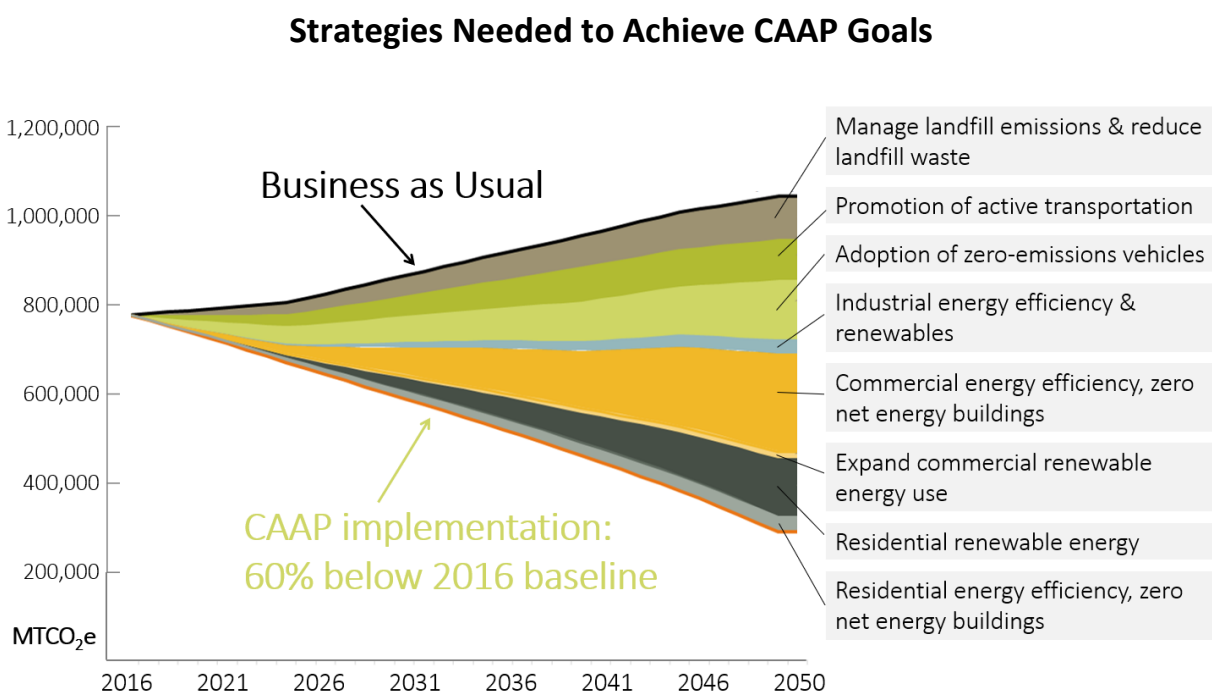
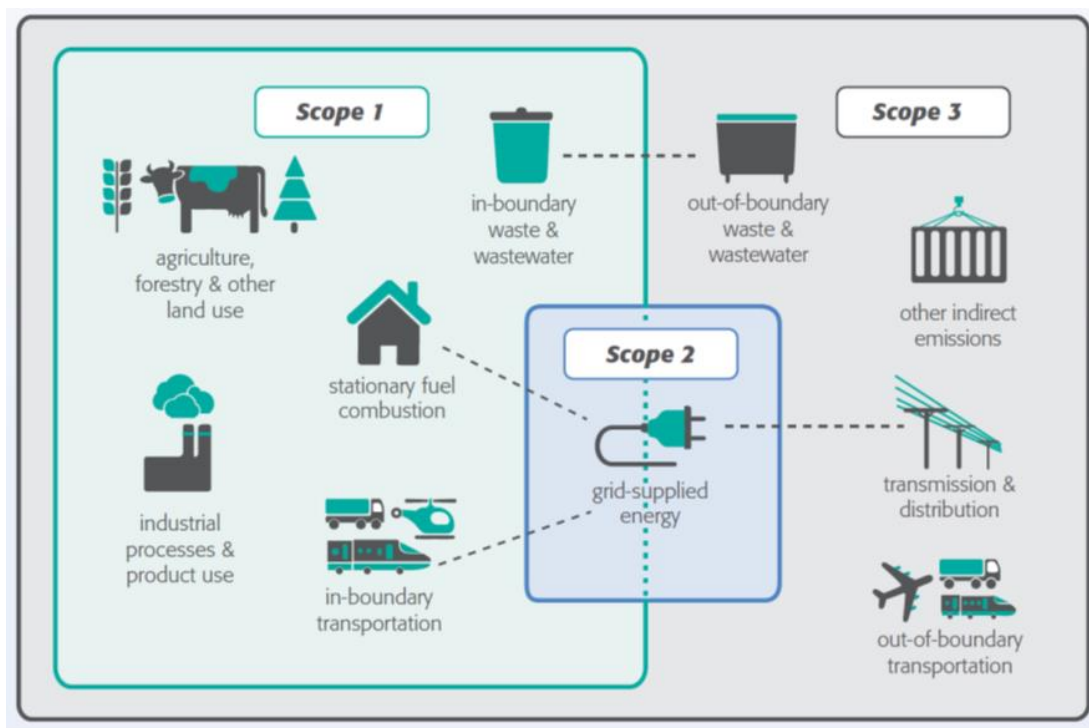


Figure 5

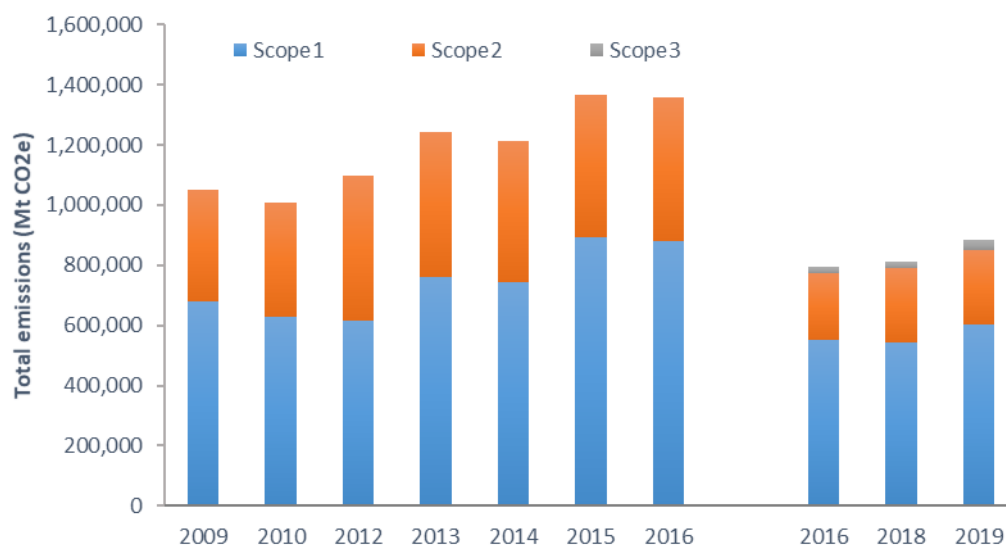
## Emissions by Scope

Emissions can also be reported by scope, which categorize emissions by their source and owner. Scope 1 represents emissions from sources located in the city boundary, scope 2 represents emissions from the use of grid-supplied energy within the city boundary, and scope 3 represents all other emissions that occur outside the city boundary as a result of activity within the city (Figure 6).

Since 2009, the City of Flagstaff Community Greenhouse Gas Inventory has included scope 1 and 2 emissions. Scope 3 emissions are a new component, beginning with the 2016 inventory (Figure 7). In 2019, emissions from power distribution and transmission losses were added for the first time. Current accounting of scope 3 emissions is not comprehensive; the amount is an underestimation of the total scope 3 emissions produced by the City. In the future, with each progressive inventory, the City of Flagstaff aspires to further develop the methods and partnerships necessary to incorporate scope 3 emissions more comprehensively.



**Figure 6.** Sources included within each scope. Images from the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories.



**Figure 7.** Scope 1 and 2 emissions were estimated for each year, but scope 3 emissions were added to the inventory in 2016, 2018, and 2019. Scope 3 emissions are underestimated.